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SOYBEAN MEAL OR UREA FED AT VARIOUS LEVELS FOR GROWING-FINISHING LAMBS

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Summary

Three hundred eighty-four ewe and wether lambs averaging about 73 lb were allotted on the basis of weight and sex group into a 2 x 4 factorial experiment with six replications per treatment. Soybean meal and urea were used as nitrogen sources with each fed at four levels of total protein. The approximate percentages of protein for the four levels were 11.2, 12.5, 13.8 and 15.1 of the dry diet. The basal diet consisted of ground corn grain and sun-cured alfalfa meal (8% dry basis) with vitamin A and mineral supplements. Soybean meal or urea was substituted for appropriate amounts of ground corn to arrive at the protein levels indicated. The diets were pelleted and fed to appetite over the 81-day experiment.

Feedlot performance during the trial showed a slight increase in feed intake with increasing levels of protein in the diet. Average daily gains and feed to gain ratios were improved with protein supplementation up to the highest level fed but decreased in degree with increasing levels of protein. These results indicate a protein requirement as much as 15% of the dry diet with weight, rate of gain and diet conditions of the experiment. This compares to the National Research Council requirement of 11% under similar conditions.

The initial response (17 days) from urea at all levels exceeded that from soybean meal. Thereafter, there were only small differences between sources of supplementation. Over the 81-day experiment, no differences were observed in rate of gain, feed consumption and feed requirements between soybean meal and urea at the various levels of supplementation.

Introduction

Recent research involving protein supplementation has shown improved performance for growing-finishing lambs fed diets which contain higher levels of protein than those recommended by the National Research Council. The improvements in animal performance at higher levels of protein supplementation indicate a need for reconsidering the protein requirements for growing-finishing lambs.

The present study was undertaken with the objective of comparing various levels of dietary protein for growing and finishing lambs using soybean meal and urea as the supplemental sources.

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Procedures

Three hundred eighty-four ewe and wether lambs were selected from a larger group which had been sheared, implanted with 12 mg of zeranol and vaccinated for prevention of overeating disease. Weight of the lambs ranged from 53 to 86 pounds.

Experimental treatments were four levels of dietary protein using soybean meal or urea for eight treatment groups. Each treatment was replicated six times using four ewes and four wethers per pen. Allotment by sex groups was at random within weight groups.

Ingredient composition of the soybean meal and urea diets is presented in tables 1 and 2, respectively. Corn grain constituted the main portion of the diets ranging from about 90% in the control diets to about 82% at the higher level of supplementation with soybean meal. Sun-cured alfalfa was included at 8% for the roughage portion of the diets. Limestone, dicalcium phosphate and potassium chloride were used to provide levels of calcium, phosphorus and potassium of .50, .35 and .60%, respectively, of the dry diets. Each diet contained .5% trace mineral salt and 1500 IU of vitamin A per pound of dry diet. Calcium sulfate was used to supply 1 part of sulfur to 10 parts of nitrogen from urea in the urea diets. Ingredients for each diet were mixed and pelleted.

TABLE 1. INGREDIENT COMPOSITION OF DIETS (SOYBEAN MEAL GROUP)

Ingredient	Protein level			
	11.2%	12.5%	13.8%	15.1%
	% of DM			
Corn grain	89.98	87.35	83.72	82.08
Soybean meal (44%)	--	2.80	5.60	8.42
Alfalfa, sun-cured	8.00	8.00	8.00	8.00
Limestone	.70	.71	.73	.75
Dicalcium phosphate	.47	.40	.32	.25
Potassium chloride	.35	.24	.13	--
Trace mineral salt	.50	.50	.50	.50
Vitamin A[a]	+	+	+	+

[a] Each diet contained 1500 IU of vitamin A per lb of dry diet.

Diets were calculated to provide levels of 11.2 (control), 12.5, 13.8 and 15.1% protein from soybean meal and from urea. Protein levels obtained by analyzing semi-weekly samples of the diets were in good agreement with those calculated for treatment levels and protein source except for treatment group 3 (table 3), where there was some variation between protein sources. Average values for both sources were the same as those formulated which were considered appropriate to designate this level of protein.

TABLE 2. INGREDIENT COMPOSITON OF DIETS (UREA GROUP)

Ingredient	Protein level 11.2%	12.5%	13.8%	15.1%
	% of DM			
Corn grain	89.98	89.57	89.16	88.76
Urea (46% N)	--	.36	.72	1.08
Alfalfa, sun-cured	8.00	8.00	8.00	8.00
Calcium sulfate	--	.10	.20	.30
Limestone	.70	.64	.58	.52
Dicalcium phosphate	.47	.48	.49	.49
Potassium chloride	.35	.35	.35	.35
Trace mineral salt	.50	.50	.50	.50
Vitamin A[a]	+	+	+	+

[a] Each diet contained 1500 IU of vitamin A per lb of dry diet.

TABLE 3. PROTEIN LEVELS IN DIETS

Treatment group	Formulated level	Analyzed level Soybean meal	Urea	Avg
	% of DM			
1	11.2[a]	11.1[a]	11.3[a]	11.2[a]
2	12.5	12.2	12.6	12.4
3	13.8	14.3	13.4	13.8
4	15.1	15.1	15.1	15.1

[a] No supplemental protein used at this level.

Prior to initiation of the experiment, lambs were changed from a diet of about .5 lb corn grain and a full feed of alfalfa haylage to the pelleted control diet over a period of 3 weeks. Upon initiation of the test diets, the daily feed was increased gradually from an initial level of 1.9 lb to a full feed offered once daily over a period of about 12 days. Thereafter, feeding was once daily in amounts to be nearly consumed by the next feeding. Lambs were weighed at 17, 41, 61 and 81 days in early morning before feeding. The experiment was terminated at 81 days when the lambs averaged about 115 pounds.

Results

Weight Gain

Weights for the lambs and average daily gains at various periods are shown in table 4. Daily gains for the 81-day experiment with averages for protein levels and sources are shown in table 5.

Weight gain data at the short intervals shown were generally quite variable. Of major concern was the response initially and at periodic intervals to decreasing levels of protein and the comparative effects of soybean meal and urea.

TABLE 4. DAILY GAIN FOR GROWING AND FINISHING LAMBS FED SOYBEAN MEAL OR UREA AT VARIOUS PROTEIN LEVELS

	Protein level							
	11.2[a]		12.5		13.8		15.1	
	Group							
Item	1	2	SBM	Urea	SBM	Urea	SBM	Urea
No. of animals[b]	48	47	46	48	44	45	45	48
Initial wt., lb	72.7	74.8	73.6	73.5	73.7	73.3	73.3	74.1
Final wt., lb	111.2	111.8	112.5	114.2	117.1	116.7	118.5	118.8
Accumulated avg daily gain, lb								
17 days	.551	.382	.499	.561	.612	.637	.628	.662
41 days	.512	.458	.546	.514	.601	.628	.597	.618
61 days	.483	.462	.527	.530	.564	.572	.559	.597
81 days	.475	.457	.478	.509	.535	.537	.558	.553

[a] No supplemental protein used at this level.
[b] Initially 48 lambs in each group but some died of acute polioencephalomalacia.

TABLE 5. DAILY GAIN FOR GROWING AND FINISHING LAMBS FED SOYBEAN MEAL AND UREA AT VARIOUS LEVELS OVER THE 81-DAY EXPERIMENT

Protein level, %	Soybean meal	Urea	Avg
	lb		
11.2[a]	.475	.457	.466
12.5	.478	.509	.493
13.8	.535	.537	.536
15.1	.558	.553	.556
Average	.512	.514	

[a] No supplemental protein used at this level.

Diets for the two groups of lambs at the 11.2% level of protein (table 4) were the same in kind and amount of ingredients without either soybean meal or urea. There was a sizable difference in daily gain between these two groups at 17 days but rather small at subsequent periods of the experiment. The average for the two groups (.466 lb) might represent more typical performance for this level of protein at this period.

At the 17-day period, rate of gain increased with increasing levels of dietary protein. There appeared to be a reduction in the rate of increase from the 13.8 to the 15.1% protein levels. While there was an advantage for the increasing levels of protein throughout the experiment, there was a decrease in response with increasing time when the lambs were heavier and with more finish.

Average daily gain at 17 days for lambs fed urea exceeded the gains of lambs fed soybean meal in the three comparisons with urea at .36, .72 and 1.08% of the dry diets. The results show no evidence for a period of adaptation to urea in comparison to soybean meal under conditions of the experiment. The lambs were adapted to the high-grain diets without either soybean meal or urea prior to including the supplemental sources of protein. There also was a gradual increase in the amount of feed offered from an initial level of approximately 2 lb per head daily to a full feed in about 12 days. Comparisons between soybean meal and urea at subsequent periods indicated similar performance from feeding the two sources at the various levels of dietary protein.

Weight gains summarized by protein levels and sources for the 81-day experiment are shown in table 5. The highest rate of gain was obtained at the highest level of protein fed (15.1%). The advantages over the non-supplemented control (11.2%) amounted to 6, 15 and 19%, respectively, for the 12.5, 13.8 and 15.1% levels of protein.

National Research Council (NRC) gives protein requirements of 11.0% of the dry diet for finishing lambs at weights from 66 to 121 lb and with daily gains of .44 to .55 pound. Results from this experiment indicate the levels of protein in the dry diet need to be as much as 15%. The preliminary period used should have been sufficient in time and level of dietary protein to overcome any possible previous protein depletion of the lambs.

The reduction in degree of response to the highest level of protein (15.1%) might serve as an indication that this level is approximately that needed by lambs under conditions of this experiment. Lambs were in a 70 to 120 lb weight range with daily gains of about .50 lb or more and a daily feed intake of approximately 2.5 pounds.

Feed Intake

Average daily feed at 17, 41, 61 and 81 days is shown in table 6. Feed intake at the 17-day period was influenced by the feeding method of gradual increases from 1.9 lb to a full feed over a period of about 12 days. In general, there was a small increase in feed consumption with increasing level of protein in the diets and with increasing time on experiment.

TABLE 6. DAILY DRY FEED FOR GROWING AND FINISHING LAMBS FED SOYBEAN MEAL OR UREA AT VARIOUS PROTEIN LEVELS

	Protein level							
	11.2[a]		12.5		13.8		15.1	
	Group							
Item	1	2	SBM	Urea	SBM	Urea	SBM	Urea
	Accumulated average daily feed intake, lb							
17 days	2.07	1.91	1.97	2.09	2.02	2.15	2.01	2.13
41 days	2.31	2.25	2.32	2.36	2.46	2.55	2.33	2.49
61 days	2.33	2.34	2.38	2.47	2.49	2.54	2.41	2.62
81 days	2.42	2.42	2.46	2.57	2.59	2.63	2.59	2.69

[a] No supplemental protein used at this level.

Feed consumption by dietary treatments and averaged for protein levels and sources is shown in table 7. These data show a small increase in feed consumption with the increasing levels of protein but less at the highest level (15.1%). Lambs fed diets with urea consumed slightly more feed than lambs fed soybean meal at each level of protein compared.

TABLE 7. DAILY DRY FEED INTAKE FOR GROWING AND FINISHING LAMBS FED SOYBEAN MEAL OR UREA AT VARIOUS LEVELS OVER THE 81-DAY EXPERIMENT

Protein level, %	Soybean meal	Urea	Avg
	Lb		
11.2[a]	2.42	2.42	2.42
12.5	2.46	2.57	2.52
13.8	2.59	2.63	2.61
15.1	2.59	2.69	2.64
Average	2.52	2.58	

[a] No supplemental protein used at this level.

Feed Efficiency

Feed efficiency data are shown by weigh periods in table 8. Feed requirements increased with increasing time on experiment which was consistent with increasing weight and finish.

Feed efficiency was improved by protein supplementation. There were only small differences between levels of protein supplementation and in favor of the higher levels.

TABLE 8. FEED EFFICIENCY FOR GROWING AND FINISHING LAMBS FED SOYBEAN MEAL OR UREA AT VARIOUS PROTEIN LEVELS

	Protein level							
	11.2[a]		12.5		13.8		15.1	
	Group							
Item	1	2	SBM	Urea	SBM	Urea	SBM	Urea
	Accumulated values for feed per 100 lb of gain							
17 days	376	500	395	373	330	338	320	322
41 days	451	491	425	459	409	406	390	403
61 days	482	506	452	466	441	444	431	439
81 days	509	530	515	505	490	490	464	486

[a] No supplemental protein used at this level.

Feed efficiency for the 81-day experiment by treatments with averages for protein levels and sources is shown in table 9. Increasing levels of protein up to the 15.1% level resulted in improved feed efficiency. Differences between soybean and urea diets at various levels fed were small and not consistently in favor of either protein source.

TABLE 9. FEED EFFICIENCY FOR GROWING AND FINISHING LAMBS FED SOYBEAN MEAL OR UREA AT VARIOUS LEVELS OVER THE 81-DAY EXPERIMENT

Protein level, %	Soybean meal	Urea	Avg
	— Lb of dry feed/100 lb of gain —		
11.2[a]	509	530	520
12.5	515	505	510
13.8	484	490	487
15.1	464	486	475
Average	493	503	

[a] No supplemental protein used at this level.